

CLAIMS

What is claimed is:

- 1 1. A system comprising:
2 a compiler to generate object code from a computer program;
3 a code optimizer to optimize the object code generated by the compiler,
4 the code optimizer including a first device to formulate regions, a second
5 device to select initial regions, a third device to apply code motion, a fourth
6 device to apply tail duplication, and a fifth device to compute $UEU(E,R)$ and
7 $DED(X,R)$, wherein $UEU(E,R)$ represents a number of upward exposed
8 registers at a main entry E of a region R that are used in the region R and
9 $DED(X,R)$ represents a number of downward exposed registers at a main exit
10 X of the region R that are defined in the region R;
11 a memory to store the compiler and the code optimizer; and
12 a central processing unit (CPU) cooperatively connected to the memory
13 to execute the compiler and the code optimizer.
- 1 2. The system of claim 1, wherein the second device selects initial
2 regions by selecting sub-control flow graphs as regions such that the region
3 starts execution mostly at the main entry and completes mostly at the main
4 exit.
- 1 3. The system of claim 1, wherein the fifth device computes
2 $UEU(E,R)$ and $DED(X,R)$ using local information from the region R.
- 1 4. The system of claim 1, wherein the third device applies code
2 motion by moving instructions outside the region R into the region R.
- 1 5. The system of claim 4, wherein the third device moves
2 instructions outside of the region R into the main entry E and the main exit X
3 of the region R.

1 6. The system of claim 5, wherein the third device moves
2 instructions outside of the region R into the main entry E and the main exit X
3 of the region R, and later moves the instructions from the main entry E and
4 the main exit X of the region R to other places inside the region R.

1 7. The system of claim 1, wherein the fourth device applies tail
2 duplication to separate reusable instructions executed along a side entry after
3 selection of initial regions.

1 8. The system of claim 1, wherein the fourth device applies tail
2 duplication during application of code motion.

1 9. A method comprising:
2 selecting initial regions;
3 computing $UEU(E,R)$ and $DED(X,R)$, wherein $UEU(E,R)$ represents a
4 number of upward exposed registers at a main entry E of a region R that are
5 used in the region R and $DED(X,R)$ represents a number of downward
6 exposed registers at a main exit X of the region R that are defined in the
7 region R;
8 applying code motion; and
9 applying tail duplication.

1 10. The method of claim 9, wherein the selecting initial regions
2 includes selecting sub-control flow graphs as regions such that the region
3 starts execution mostly at the main entry and completes mostly at the main
4 exit.

1 11. The method of claim 9, wherein the computing $UEU(E,R)$ and
2 $DED(X,R)$ is performed using local information from the region R.

1 12. The method of claim 9, wherein the applying code motion
2 includes moving instructions outside the region R into the region R.

1 13. The method of claim 12, wherein the moving instructions
2 outside the region R into the region R includes moving instructions outside of
3 the region R into the main entry E and the main exit X of the region R.

1 14. The method of claim 13, wherein the moving instructions
2 outside of the region R into the region R further includes moving instructions
3 from the main entry E and the main exit X of the region R to other places
4 inside the region R.

1 15. The method of claim 9, further comprises applying tail
2 duplication to separate reusable instructions executed along a side entry after
3 selection of initial regions.

1 16. The method of claim 1, further comprises applying tail
2 duplication during application of code motion.

1 17. A machine-readable medium comprising instructions which,
2 when executed by a machine, cause the machine to perform operations
3 comprising:
4 selecting initial regions;
5 computing $UEU(E,R)$ and $DED(X,R)$, wherein $UEU(E,R)$ represents a
6 number of upward exposed registers at a main entry E of a region R that are
7 used in the region R and $DED(X,R)$ represents a number of downward
8 exposed registers at a main exit X of the region R that are defined in the
9 region R;
10 applying code motion; and
11 applying tail duplication.